

battery sizes usable in these products within hours, or days, at best. Larger batteries could increase battery life, but these are costly and their bulk is not appropriate in the application of a doorbell button. Early, non-high intensity type, LED light sources, while operable for far longer periods than incandescent sources, still cannot operate at the very low current levels required to obtain desirable battery life objectives of one year or longer while emitting useful levels of light.

The paragraph beginning on page 2, at line 1.

Battery life can be extended for an LED device by causing the LED to blink on and off. This can also serve to attract attention to the device. For a residential application however, most consumers do not want to have a blinking LED marking their doorbell, driveway, or sidewalk. Operating the LED on a continuous basis may be more attractive to consumers, but would require substantially more power.

The paragraph beginning on page 2, at line 7.

Reflector based markers and some types of landscape lights could also benefit from a long life battery powered luminaire. Roadside, bicycle and driveway reflector products are very effective when a bright source of light shines directly on them. Otherwise, such reflectors are ineffective. A self-lighted marker has the advantage of being visible without an external source of light directed on it, so that it is visible to walkers, joggers and bicyclists at night. Such a marker would also be useful in driving situations where the marker is outside the normal field of the car's headlights. Roadside reflectors have been proposed that have made use of solar charging systems for batteries. Rechargeable batteries are bulky and the solar cells and recharging circuits can add substantially to the relative cost of the product. Solar cells must be placed in locations that receive direct sunlight during some part of the day, and, as a consequence, may not work in a shaded location. During winter at high latitudes very little sunlight is received, reducing the effectiveness of these products.

The paragraph beginning at page 2, on line 20.

Under conditions of darkness, it does not require much light output to make an object visible. The human eye has great light intensity adaptability. The differences in eye sensitivity between conditions of bright sunlight (photopic vision) and fully night adapted vision (scotopic vision) can vary by a factor of 25,000 and instances of adaptation up to a factor of 1,000,000 times have been documented. Multiple mechanisms within the eye provide this adaptability, some responding quickly to changing light conditions, e.g. pupil dilation, and some slowly, e.g. maximum rod sensitivity, so that fully night adapted vision is not achieved for up to 30 minutes. The implication of this is that levels of light useless under normal indoor lighting conditions, can become useful under conditions where one can anticipate people will have adapted to darkened conditions. The spectrum of light generated makes a difference in the minimum radiant intensity required for human perception. Generally people can see broad spectrum or white light more readily than they can see narrow spectrum light of the same intensity.

The paragraph beginning on page 3, at line 1.

Visible spectrum applications of light emitting diodes have long included simple status indicators and dynamic power level bar graphs. Display applications have grown in number and super bright LEDs are used in various automotive and traffic signal applications. Super bright LEDs are extremely efficient in terms of the percentage of input power converted to visible radiation compared with devices previously known. This is one reason they are favored for applications requiring the output of high intensity light. Super bright LED devices are available which emit any one of a variety of colors, or which emit broad spectrum radiation. Some super bright LEDs also work over broad ranges of drive currents and emit low intensity light at low drive currents and with low power consumption. These LEDs exhibit efficiencies at low power levels comparable to the high efficiencies achieved at the much higher power levels at which they are designed to operate. United States Patent 6,140,776 to Rachwal teaches a flashlight that exploits low power operation of super bright LEDs in one application.

Delete the paragraph beginning on page 3, at line 14.

The paragraph beginning on page 3, at line 22.

The invention provides a marker luminaire combining a super bright LED and a low energy drive circuit to promote long battery life. Such a luminaire comprises a housing and a lamp disposed in the housing capable of producing light visible to a partially darkness adapted human eye. A minimal current is selected to produce enough light to be seen at the desired distances. A light scattering element is optically associated with the lamp to make the marker light visible across a wide viewing angle and thereby indicate the location of the housing. The electrical drive circuit provides the minimal current to the lamp. The electrical drive circuit may further comprise a photosensitive element responsive to high and low ambient light conditions for cycling operation of the LED. A replaceable electrical power cell is positioned in the housing in the electrical drive circuit as a power source.

Add the following paragraph before the paragraph to page 4 before the paragraph beginning on page 4 at line 1.

The terms white light and broad spectrum radiation are used broadly in this patent. The present invention uses LEDs which emit a spectrum blend of visible light on an illuminated surface at a near minimum intensity level which produces a physiological response in a normal human eye. The terms white light and broad spectrum are thus used in the sense of any spectrum output producing greater perceived brightness than monochrome radiation generated at the same energy level.

The paragraph beginning on page 5, at line 9.

Due to the nature of the human eye, monochrome LEDs operating at the same efficiency as a broad spectrum or white light LED require substantially more current than do the broad spectrum LEDs to achieve the same perceived brightness level. Since contemporary

monochrome super bright LEDs do not exhibit substantially greater efficiencies in light generation compared to broad spectrum LEDs, super bright white LEDs may be operated at a current which is small fraction of the rated current for the diode, and at a lower current than a monochrome LED, and still provide a level of illumination useful as a marker for darkness adjusted vision. At the time this patent was written, broad spectrum LEDs are preferred for the marker applications described herein. However, should technical developments lead to monochrome or limited spectrum LEDs exhibiting much higher efficiencies than white LEDs, than such devices might also produce perceptible light at a lower current than a white LED and come to be preferred for many of these applications.

The paragraph beginning on page 5, at line 21.

A luminaire used for marking the location of an object need not be particularly bright under circumstances where it can be expected that a person looking for the object will have partially darkness adapted vision. Contemporary, super bright, white LEDs rated at 15 to 20 milliamps can be operated in ranges extending from just below 5 milliamps to a few microamps and produce perceptible light. Extraordinarily long battery life for a luminaire can be achieved at these current levels. Battery life can be further extended by turning the LEDs on and off based on the need for light. For example, an ambient light sensitive control circuit may be used to turn off the luminaire during daylight. Using the low-level white LED approach and a daylight sensor, it is possible to obtain battery life in the range of 1-3 years for some applications using typical small lithium coin cells.

The paragraph beginning on page 6, at line 31.

LED 22 is positioned very near, or partially within, and optically coupled to, a translucent ring 30. When activated, either by the switch 18 or the CdS light sensor 24, LED 22 emits light which is coupled into the ring 30 and produces a glow which surrounds push-button 20. The translucent material of ring 30 scatters the light and distributes it throughout the ring,

which is visible across a broad angle. At night, when the push-button **20** has not been pressed, the ring **30** glows at a low level from light from the LED. A normal eye that has achieved some degree of night adaptation can readily see the ring **30** and identify the push-button **20**. Upon push-button **20** being pressed the ring glows at a second, substantially higher level, indicating that the device is operating.

Delete the paragraph beginning on page 9, at line 3.

The paragraph beginning on page 11, at line 10.

Case **70** further includes a light reflecting surface positioned behind a translucent lens **84**, which in turn forms a substantial portion of the front of the case. LED **78** is positioned within case **70** above and just behind translucent lens **84**, but forward of light reflecting surface **82**. LED **78** is oriented to cast light downwardly both onto the light reflecting surface as well as directly on the translucent lens **84**. The pattern of light created by LED **78** is typically a cone with its point at the LED's tip that expands symmetrically about the LED's central axis in a direction away from the LED. Where the cone of light intersects the translucent lens **84**, the lens scatters the light causing the lens to glow and to become visible from a wide band of viewing angles relative to the case **70**. However, the glow is not of a uniform intensity since the translucent lens **84** has a curved surface and various areas of the lens are at different distances from LED **78**. Much of the light emitted by LED **78** does not directly strike lens **84** and thus does not add directly to the brightness of the lens.

The paragraph beginning on page 13, on line 29.

When compared with landscape lights, the driveway marker lights of the present invention exhibit the advantage of being self-contained. As such, installation of the product is very simple. This is especially important because driveway markers are often located at points that are the most remote within the yard from a source of power. Compared with solar products